

# PATENT ABSTRACTS OF JAPAN

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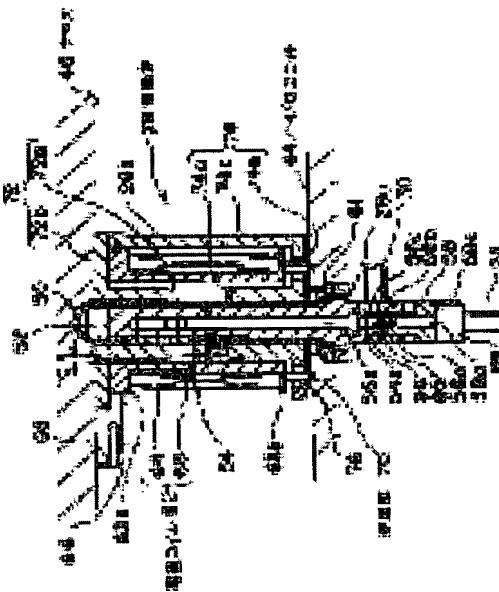
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## (54) SOLENOID VALVE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To fix a coil to a valve block with a simple structure, in relation to a solenoid valve provided with a plunger part attached to the valve block so as to protrude from the valve block, and a coil disposed around the plunger part.

**SOLUTION:** A solenoid valve 28 is composed of a hydro unit part 28a which is provided with a plunger 52 and a core 56 and assembled with a hydro unit 44, and a case part 28b which is provided with an electromagnetic coil 62 and yokes 72, 74 and which is fixed to a case 46. A protrusion part 70 capable of elastically deforming is formed integratedly with a flange part 63b of a bobbin 63 of the electromagnetic coil 62. When the case part 28b is assembled with the hydro unit part 28a, the protrusion part 70 is elastically deformed between the hydro unit 44 and the case 46.



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**[Claim(s)]**

**[Claim 1]** The solenoid valve characterized by to form the height in which elastic deformation is possible in the field which counters the aforementioned valve block of the aforementioned coil in a solenoid valve equipped with the plunger section attached in this valve block so that it might project from a valve block, and the coil which was attached in covering fixed so that the front face of this valve block might be worn, and has been arranged around the aforementioned plunger section.

**[Detailed Description of the Invention]****[0001]**

[The technical field to which invention belongs] this invention relates to a solenoid valve, it is attached in the plunger section attached in this valve block, and covering fixed so that the front face of a valve block might be worn so that it may project from a valve block especially, and it relates to a solenoid valve equipped with the coil arranged around the plunger section.

**[0002]**

[Description of the Prior Art] Conventionally, the solenoid valve used for the hydraulic brake equipment which performs anti-lock brake control etc. is known so that it may be indicated by JP,8-145224,A. This solenoid valve is constituted by the coil arranged around the plunger section which carried out the interior of a core and the plunger to the part which projects from a valve block, and the lobe of this valve block, and the yoke arranged around a coil. In the above-mentioned composition, when the exciting current is not supplied to a coil, the predetermined air gap is formed between the core and the plunger. If an exciting current is supplied to a coil in this state, the air gap between a core and a plunger can be decreased in the electromagnetic force which goes to a core acting on a plunger. Therefore, according to the above-mentioned conventional solenoid valve, a fluid-pressure path can be flowed through or intercepted by supplying the suitable exciting current for a coil.

**[0003]**

[Problem(s) to be Solved by the Invention] By the way, in order to carry out the opening-and-closing drive of the solenoid valve proper, it is necessary to certainly fix the coil which constitutes a solenoid valve to a valve block. In the above-mentioned conventional solenoid valve, when energized by the spring attached in covering attached to a valve block, sticking-by-pressure fixation of the coil is carried out to the valve block. However, it is necessary to arrange appropriately the spring which turns a coil to a valve block and energizes it by this fixed technique. For this reason, in the above-mentioned solenoid valve, while an attachment man day increases, a manufacturing cost will increase by increase of part mark.

[0004] this invention is made in view of an above-mentioned point, and aims at offering the solenoid valve which can fix a coil to a valve block with simple composition.

[0005]

[Means for Solving the Problem] The above-mentioned purpose is attached in covering fixed so that the plunger section attached in this valve block so that it might indicate to a claim 1 and might project from a valve block, and the front face of this valve block may wear, and is attained by the solenoid valve carry out that the height in which elastic deformation is possible is formed in the field which counters the aforementioned valve block of the aforementioned coil as the feature in a solenoid valve equipped with the coil arranged around the aforementioned plunger section.

[0006] In this invention, the height in which elastic deformation is possible is formed in the field which counters the valve block of a coil. if a coil attaches attachment \*\*\*\* covering to a valve block, elastic deformation of the height of a coil will be carried out by the pushing force from the front face of a valve block If the height of a coil carries out elastic deformation, the energization force will occur in the sense which makes both estrange between a valve block and covering. This energization force acts as force which pinches a coil between a valve block and covering. For this reason, a coil is certainly fixed to a valve block. Therefore, according to this invention, a coil is fixable to a valve block with simple composition by preparing a height in a coil.

[0007]

[Embodiments of the Invention] Drawing 1 shows the system configuration view of an example of hydraulic brake equipment 10 equipped with the solenoid valve which is one example of this invention. The hydraulic brake equipment 10 of this example is equipped with the electronic control unit (ECU is called hereafter) 12. Hydraulic brake equipment 10 generates the damping force according to brakes operation, when controlled by ECU12. In addition, in drawing 1, the fluid-pressure circuit of the forward left ring floor line is shown.

[0008] Hydraulic brake equipment 10 is equipped with the brake pedal 14. The brake pedal 14 is connected with the operation shaft 18 of the brake booster 16. The brake booster 16 generates the assistant force of having a predetermined redoubling ratio to brake treading strength, when it gets into a brake pedal 14. The master cylinder 20 is being fixed to the brake booster 16. The master cylinder 20 equips the interior with the fluid-pressure room. In this fluid-pressure room, master cylinder \*\* according to resultant force with brake treading strength and the assistant force occurs.

[0009] The fluid-pressure path 24 is connected to the fluid-pressure room of a master cylinder 20. In the fluid-pressure path 24, the control fluid-pressure path 30 is open for free passage through a solenoid valve 28. The relief valve 32 is arranged in parallel by the solenoid valve 28. A solenoid valve 28 is a two position valve which will be in a valve-closing state by maintaining a valve-opening state by the ordinary state, and supplying a driving signal from ECU12. A relief valve 32 is a constant-pressure open valve which permits the flow of brake Froude who goes to the fluid-pressure path 24 side from the control fluid-pressure path 30 side, when the fluid pressure by the side of the control fluid-pressure path 30 is high pressure exceeding predetermined relief \*\* as compared with the fluid pressure by the side of the fluid-pressure path 24. In addition, the composition of a solenoid valve 28 is explained in detail later.

[0010] The wheel cylinder 34 of the forward left ring floor line is connected to the control fluid-pressure path 30. To the wheel cylinder 34, the fluid-pressure path 38 is open for free passage through a solenoid valve 36. A solenoid valve 36 is a two position valve which will be in a valve-opening state by maintaining a valve-closing state by the ordinary state, and supplying a driving signal from ECU12. The fluid-pressure path 38 is open for free passage to the auxiliary reservoir 40. The auxiliary reservoir 40 stores brake Froude who flowed out of the control fluid-pressure path 30 side into the fluid-pressure path 38.

[0011] The hydraulic brake equipment 10 shown in drawing 1 realizes the usual function (a brake function is usually called hereafter) to generate the damping force according to brake treading strength, and the anti-lock brake function (a ABS function is called hereafter) to prevent that slip ratio excessive for a wheel breaks out during brakes operation. usually, a brake function is shown in drawing 1 -- as -- solenoid valves 28 and 36 -- both -- OFF state 28, i.e., a solenoid valve, -- a valve-opening state -- and it realizes by maintaining a solenoid valve 36 in the valve-closing state If this state is realized, a master cylinder 20 and a wheel cylinder 34 will be in switch-on. In this case, wheel cylinder \*\* of a wheel cylinder 34 is controlled as isotonic as master cylinder \*\*. Therefore, in the hydraulic brake equipment 10 of this example, the damping force

according to brake treading strength can usually be generated at the time.

[0012] A ABS function is in the state of getting into the brake pedal 14, and is realized by opening and closing solenoid valves 28 and 36 suitably. both the solenoid valves 28 and 36 maintain to an OFF state in the state of getting into the brake pedal 14 -- having (state shown in drawing 1) -- a master cylinder 20 and a wheel cylinder 34 will be in switch-on In this case, it boosts wheel cylinder \*\* towards master cylinder \*\*. Hereafter, this state is called boost mode.

[0013] Moreover, if a solenoid valve 36 is maintained by the OFF state and a solenoid valve 28 is made into an ON state, a master cylinder 20 and a wheel cylinder 34 will be in a cut off state. In this case, wheel cylinder \*\* is held. Hereafter, this state is called a hold mode. Furthermore, if both the solenoid valves 28 and 36 are made into an ON state, a master cylinder 20 and a wheel cylinder 34 will be in a cut off state, and a wheel cylinder 34 and the auxiliary reservoir 40 will be in switch-on. In this case, wheel cylinder \*\* is decompressed because brake Froude in a wheel cylinder 34 flows out towards the auxiliary reservoir 40. Hereafter, this state is called reduced pressure mode.

[0014] According to the above-mentioned ABS function, wheel cylinder \*\* of a wheel is controllable to a proper pressure so that excessive slip ratio does not arise. For this reason, all wheels can be made to generate big damping force, without making a wheel lock according to the hydraulic brake equipment 10 of this example, when brakes operation is performed by the operator.

[0015] Next, with reference to drawing 2 and drawing 3, the composition of the solenoid valves 28 and 36 with which the hydraulic brake equipment 10 of this example is equipped is explained. In addition, the solenoid valve 28 and the solenoid valve 36 have the same composition except for the composition about the state of the core in an ordinary state, and a plunger. For this reason, below, the composition of a solenoid valve 28 is explained as the representative.

[0016] Drawing 2 shows the state before the assembly of the hydraulic brake equipment 10 of this example. In addition, in drawing 2, although four solenoid valves are shown among the solenoid valves with which hydraulic brake equipment 10 is equipped, the solenoid valves 28 and 36 corresponding to all wheels are attached to the hydro unit 44 and the case 46. As shown in drawing 2, hydraulic brake equipment 10 is equipped with the hydro unit 44 in which the above-mentioned fluid-pressure circuits 24 and 30 are formed, and the case 46 by which bolting arrival is carried out to the hydro unit 44. In addition, the hydro unit 44 consists of members of aluminum etc. which can be deformed plastically.

[0017] Drawing 3 shows the cross section of the solenoid valve 28 after the assembly of

the hydraulic brake equipment 10 of this example. As shown in drawing 3, the solenoid valve 28 is constituted by hydro unit section 28a included in the hydro unit 44, and case section 28b fixed to a case 46. Hydro unit section 28a of a solenoid valve 28 is equipped with the sleeve 50. A sleeve 50 is the member constituted with the tubed non-magnetic material which the upper-limit side which extends in shaft orientations closed. The plunger 52 is inserted in the interior of a sleeve 50. A plunger 52 is the member constituted by the magnetic material which has a slightly small outer diameter as compared with the bore of a sleeve 50. It turns caudad and pressing fixation of the extending movable shaft 54 in drawing 3 is carried out at the plunger 52. The movable shaft 54 is the member of the shape of a rod constituted with the non-magnetic material. [0018] The core 56 is pressed fit in the sleeve 50. The core 56 has breakthrough 56a which has a slightly big path in the center section as compared with the outer diameter of the movable shaft 54. The movable shaft 54 is held possible [ sliding of the interior of breakthrough 56a of a core 56 ]. Body 56b is formed in the soffit of a core 56. The valve seat 58 is pressed fit in body 56b from the lower part side of a core 56. Fluid-channel 58a is formed in the center section of the valve seat 58. Moreover, orifice 58b is prepared in the edge by the side of a core 56 of fluid-channel 58a.

[0019] Poppet 54a prepared in the soffit of the movable shaft 54 has countered opening of orifice 58b. Predetermined path clearance is formed between opening of orifice 58b, and poppet 54a. Orifice 58b is constituted so that it may open and close by the operation of poppet 54a. Moreover, between the valve seat 58 and the movable shaft 54, the spring 60 which generates the energization force in the sense which makes both estrange is arranged. For this reason, the air gap G of predetermined length is formed by the ordinary state between the plunger 52 and the core 56.

[0020] In the above-mentioned composition, hydro unit section 28a of a solenoid valve 28 is attached to the hydro unit 44. At the time of attachment by the hydro unit 44, after hydro unit section 28a is inserted in the attaching hole prepared in the hydro unit 44, the periphery of the opening side edge section of a sleeve 50 is equipped with the annular retainer 61. Hydro unit section 28a is fixed to the hydro unit 44 by closing the periphery side of a retainer 61.

[0021] The fluid-pressure path 65 which has a slightly big path as compared with the outer diameter of container-liner section 56b of a core 56 and flange 58c of a valve seat 58 is formed in the hydro unit 44. The fluid-pressure path 65 is open for free passage to the fluid-pressure path 24 mentioned above. Moreover, through-hole 56c which opens a building envelope and outer space for free passage is prepared in container-liner section 56b of a core 56. The through hole 56 is open for free passage to the control

fluid-pressure path 30 mentioned above. Therefore, in the above-mentioned composition, when poppet 54a displaces to shaft orientations in connection with the variation rate of a plunger 52, the switch-on and the cut off state of the fluid-pressure path 24 and the control fluid-pressure path 30 are changed.

[0022] the annular electromagnetism in which case section 28b of a solenoid valve 28 is arranged around a sleeve 50 -- it has the coil 62 electromagnetism -- the coil 62 is constituted by the bobbin 63 and the coil 64 \*\*\*\*(ed) around the bobbin 63 A bobbin 63 is the member constituted by the material of a resin etc. in which elastic deformation is possible, and has flanges 63a and 63b in the upper-limit section and the soffit section in drawing 3, respectively. The handle section 66 is being fixed to flange 63a of a bobbin 63. electromagnetism -- a coil 62 is fixed to a case 46 by welding the handle section 66 to the handle section 68 of a case 46 Two or more heights 70 in drawing 3 which project caudad are formed in flange 63b of a bobbin 63 at one.

[0023] electromagnetism -- around the coil 62, the yokes 72 and 74 constituted by the magnetic material are arranged a yoke 72 -- electromagnetism -- it has flange 72b formed in the upper limit of tubed part 72a prolonged in shaft orientations, and tubed part 72a in the inside of a coil 62 a yoke 74 -- electromagnetism -- container-liner section 74a prolonged in shaft orientations in the inside of a coil 62, and electromagnetism -- it has flange 74c which connects outer case section 74b prolonged over the overall length in shaft orientations in the periphery of a coil 62, and container-liner section 74a and outer case section 74b in the soffit section of them flange 74c -- electromagnetism -- it has the breakthrough 76 which has a big path as compared with the outer diameter of the height 70 formed in the coil 62 The breakthrough 76 is formed in the position corresponding to a height 70.

[0024] as for a yoke 72 and a yoke 74, a height 70 is inserted in a breakthrough 76 -- as -- electromagnetism -- a caulking is fixed after carrying out the interior of the coil 62 before, as for yokes 72 and 74, the hydro unit 44 and a case 46 are attached -- electromagnetism -- it is not fixed to the coil 62 namely, electromagnetism -- path clearance is formed between the inner circumference section of the bobbin 63 of a coil 62, and tubed part 72a of a yoke 72, and between the inner circumference section of a bobbin 63, and container-liner section 74a of a yoke 74 and -- if the hydro unit 44 and a case 46 are attached -- yokes 72 and 74 -- flange 72b of a yoke 72 -- electromagnetism -- being pinched between flange 63a of a coil 62, and a case 46 -- electromagnetism -- while being fixed to a coil 62, it is fixed to a case 46

[0025] this example -- setting -- electromagnetism -- when the exciting current is not supplied to a coil 62, between the plunger 52 and the core 56, the predetermined air gap

G is formed of the energization force of a spring 60 In this state, it is that poppet 54a prepared in moving part 54 \*\*\*\* from a valve seat 58, and the fluid-pressure path 24 and the control fluid-pressure path 30 are maintained by switch-on.

[0026] electromagnetism -- if an exciting current is supplied to a coil 62 -- electromagnetism -- around a coil 62, the magnetic flux flowing back generates the inside and outside Generating of such magnetic flux generates the electromagnetic force which draws both near between a plunger 52 and a core 56. If this electromagnetic force exceeds the energization force of a spring 60, the movable shaft 54 will begin to displace in the lower part in drawing 3. And when the movable shaft 54 displaces until the plunger 52 contacted the core 56, and poppet 54a sits down to a valve seat 58, the fluid-pressure path 24 and the control fluid-pressure path 30 are made into a cut off state.

[0027] thus -- according to the above-mentioned composition -- electromagnetism -- according to turning on and off of the exciting current to a coil 62, the switch-on and the cut off state of the fluid-pressure path 24 and the control fluid-pressure path 30 can be changed Next, with reference to above-mentioned drawing 2 and drawing 3, how to assemble hydraulic brake equipment 10 is explained.

[0028] in this example, a height 70 penetrates to a breakthrough 76 first -- as -- electromagnetism -- a coil 62 -- a yoke 74 -- inserting -- electromagnetism -- a yoke 72 is put so that tubed part 72a may be inserted in the inside of a coil 62, and caulking fixation of a yoke 72 and the yoke 74 is carried out and the electromagnetism by which interior was carried out to yokes 72 and 74 -- while pushing a coil 62 towards a case 46 side from the lower part in drawing 3 -- electromagnetism -- the handle section 66 fixed to the coil 62 is welded to the handle section 68 of a case 46

[0029] next, electromagnetism -- the case 46 where the coil 62 was fixed is positioned to the hydro unit 44 so that a sleeve 50 may penetrate the tubed parts 72a and 74a of yokes 72 and 74 And a case 46 is put firmly on the hydro unit 44 with a bolt, and it fixes. Thereby, attachment of a solenoid valve 28 is completed. in addition, this example -- setting -- electromagnetism -- as for the height 70 of a coil 62, the point can penetrate the breakthrough 76 of a yoke 74, and only the specified quantity can eat into the hydro unit 44 -- as -- electromagnetism -- it is designed in consideration of the overall height of a coil 62, and the desired interval of the hydro unit 44 and a case 46

[0030] the above-mentioned composition -- setting -- electromagnetism -- the coil 62 is being fixed to the case 46 like \*\*\*\* for this reason -- if a case 46 is attached to the hydro unit 44 -- electromagnetism -- big pushing force acts on the height 70 of a coil 62 from the front face of the hydro unit 44 The height 70 is constituted like \*\*\*\* by the material

in which elastic deformation is possible. For this reason, if pushing force acts on a height 70, the energization force will occur in the sense which makes both estrange between a case 46 and the hydro unit 44 because a height 70 carries out elastic deformation. in this case, this energization force -- electromagnetism -- it acts as force which pinches a coil 62 between a case 46 and the hydro unit 44 electromagnetism [ as opposed to / even when it changed into this state and disturbance and size errors, such as vibration, arise / the hydro unit 44 ] -- the variation rate of a coil 62 can be prevented namely, -- according to this example -- electromagnetism -- a coil 62 is fixable to the hydro unit 44

[0031] like \*\*\*\* -- the solenoid valve 28 of this example -- the elastic deformation of a height 70 -- electromagnetism -- it is the composition which fixes a coil 62 to the hydro unit 44 therefore -- according to this example -- simple composition -- electromagnetism -- a coil 62 is fixable to the hydro unit 44 For this reason, according to this example, increase of the physique can be suppressed while being able to suppress the increase of an attachment man day and the elevation of a manufacturing cost accompanying increase of part mark.

[0032] if a case 46 is attached to the hydro unit 44 like \*\*\*\* in this example -- electromagnetism -- the pushing force from the hydro unit 44 acts on a coil 62 in this case, flange 72b of a yoke 72 -- electromagnetism -- being pressed by the coil 62 -- it is -- a case 46 and electromagnetism -- it is pinched between flange 63a of a coil 62 Like \*\*\*\*, the yoke 72 and the yoke 74 of each other are being fixed by the caulking. Therefore, yokes 72 and 74 are [ both ] fixable according to this example to a case 46 and the hydro unit 44 by pinching flange 72b of a yoke 72 between a case 46 and flange 63a.

[0033] thus -- according to this example -- electromagnetism -- the solenoid valve 28 certainly fixed to the hydro unit 44 equipped with the sleeve 50 to which the interior of a core 56 and the plunger 52 was carried out in a coil 62 and yokes 72 and 74 is realizable For this reason, according to the hydraulic brake equipment 10 of this example, it becomes possible to secure the proper opening-and-closing drive of a solenoid valve 28.

[0034] like \*\*\*\* -- this example -- setting -- electromagnetism -- a coil 62 is fixed to a case 46 by the handle section 66 being welded to a case 46 in order to aim at improvement in quality in this composition -- the electromagnetism from the hydro unit 44 -- it is desirable for the pushing force transmitted to a coil 62 not to act on the above-mentioned weld zone as big stress this example -- setting -- electromagnetism -- flange 72b of a yoke 72 is arranged between flange 63a of a coil 62, and the case 46 For this reason, the great portion of above-mentioned pushing force acts as force which presses flange 72b of a yoke 72. Therefore, according to this example, it is prevented

that big stress acts on a weld zone, and it can aim at improvement in the quality of a solenoid valve 28.

[0035] before [ moreover, ], as for yokes 72 and 74, the hydro unit 44 and a case 46 are attached in this example -- electromagnetism -- it is not fixed to the coil 62 namely, electromagnetism -- path clearance is formed between the inner circumference section of the bobbin 63 of a coil 62, and tubed part 72a of a yoke 72, and between the inner circumference section of a bobbin 63, and container-liner section 74a of a yoke 74 for this reason, the electromagnetism fixed to the case 46 when attaching a case 46 to the hydro unit 44 -- change of the relative position of a coil 62 and the sleeve 50 which carried out the interior of the core 56 and plunger 52 which were fixed to the hydro unit 44 is permissible by above-mentioned path clearance

[0036] therefore -- according to this example -- electromagnetism -- the case where a coil 62 carries out a position gap for some from a regular position, and is being fixed to the case 46 -- electromagnetism -- it becomes possible to attach a case 46 to the hydro unit 44, without a coil 62 and a sleeve 50 interfering for this reason, electromagnetism -- positioning at the time of fixing a coil 62 to a case 46 by welding can be eased, and a solenoid valve 28 can be attached easily

[0037] in addition, "covering" which the case 46 indicated at the claim in the "plunger section" which the sleeve 50 which equipped with the plunger 52 and the core 56 the "valve block" which the hydro unit 44 indicated to the claim in the above-mentioned example indicated to the claim -- electromagnetism -- the coil 62 is equivalent to the "coil" indicated to the claim, respectively By the way, what is necessary is not to limit this invention to this and just to apply it to the solenoid valve of composition of arranging a coil in the circumference of the part which projects from a valve block in the above-mentioned example, although applied to the solenoid valves 28 and 36 which hydraulic brake equipment 10 equips with this invention.

[0038]

[Effect of the Invention] According to this invention, like \*\*\*\*\*, a coil is fixable to a valve block with simple composition.

#### **[Brief Description of the Drawings]**

**[Drawing 1]** It is the system configuration view of an example of hydraulic brake equipment equipped with the solenoid valve which is one example of this invention.

**[Drawing 2]** It is drawing showing the state before the assembly of the hydraulic brake equipment of this example.

**[Drawing 3]** It is the cross section of the solenoid valve after the assembly of the

hydraulic brake equipment of this example.

[Description of Notations]

**28 36 Solenoid valve**

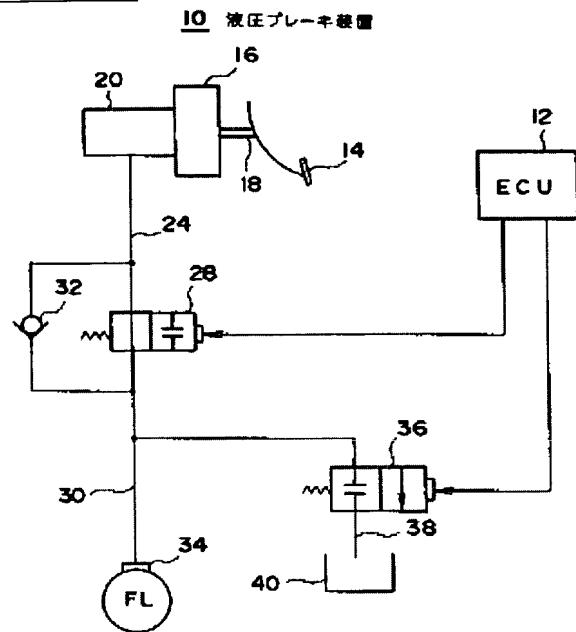
**44 Hydro Unit**

**46 Case**

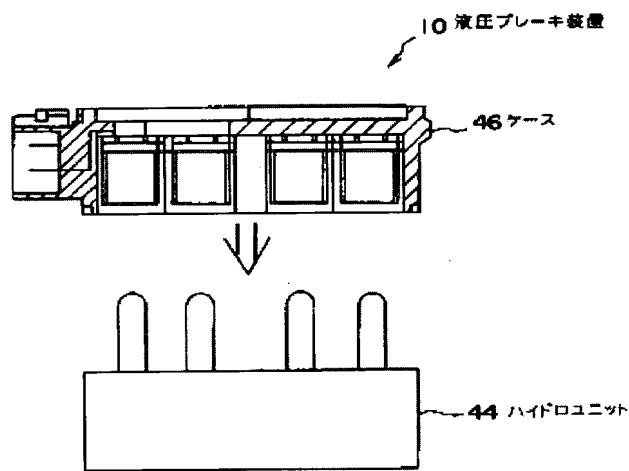
**62 Electromagnetism -- Coil**

**70 Height**

[Drawing 1]



[Drawing 2]



[Drawing 3]

